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UAC Research Dept. Report M-95434-12

Date: October 8, 1951

Prepared by: H. D. Taylor

Monthly Progress Report - September, 1951

Transonic Test Section Development

Air Force Contract AF 33(038)-9451

Supplemental Agreement No. 5 (S-52-146)

E. O. R-465-6 BR-1

The following progress report for the month of September, 1951 is submitted in compliance with the requirements of the above noted contract.

Discussion of Progress

The initial tests with the new 6" x 6 $\frac{1}{4}$ " porous wall transonic tunnel were directed toward determining if an essentially square section would give considerably better test section flow than obtained previously with the octagonal section (6.7" across the flats). Results of these tests (using a subsonic nozzle for comparison) were encouraging in that the deviations of test section Mach number obtained in the 6" x 6 $\frac{1}{4}$ " section were considerably less than those obtained previously in the octagonal section. This improvement in flow was realized as a result of elimination of the overexpansion and subsequent compression obtained with the octagonal section. Since the porosity of the plates were similar (22% open) in each tunnel, this elimination of the overexpansion phenomena can be attributed to the reduction of the focusing effect by using a square section.

The next series of tests with the 6" x 6 $\frac{1}{4}$ " section were directed toward determining techniques of removing essentially all of the boundary layer on all four of the test section walls. Results of two-dimensional tests reported in Reference 1 which has been forwarded to the Air Force have demonstrated that shock cancellation by a porous wall can only be realized if the wall boundary layer is removed. Initial data obtained with the 6" x 6 $\frac{1}{4}$ " section have indicated the following:

- (1.) Provisions for removing boundary layer ahead of the Mach number one station of a subsonic nozzle and possibly over the entire length of a Laval nozzle will probably be necessary if the boundary layer is to be removed at the test section.
- (2.) Provisions for converging each of two of the four walls by approximately 2° (small scale tunnel) will probably be necessary for complete removal of the boundary layer.
- (3.) The porosity of parallel side walls may have to be somewhat larger (more open) than that of the top and bottom walls if wall convergences greater than approximately 2° are to be avoided.

Studies such as discussed above are believed necessary before setting-up for tests with a Laval nozzle in combination with a porous test section.

H. D. Taylor
H. D. Taylor

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Reference

1. Pindzola, M. - Shock and Expansion Wave Cancellation Studies in a Two-Dimensional Porous Wall Transonic Tunnel; UAC Research Dept. Report R-25473-5; September 11, 1951.

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